IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re patent application of

Lu et al.

Serial No.: 09/296,588 **Group Art Unit:** 2871

Filed: April 23, 1999 **Examiner:** Qi Zhi Qian.

For: METHODS OF REDUCING UNBALANCED DC VOLTAGE BETWEEN TWO ELECTRODES OF REFLECTIVE LIQUID DISPLAY BY THIN FILM PASSIVATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S APPEAL BRIEF

Sirs:

Appellants respectfully appeal the final rejection of claims 1-20 in the final Office Action dated January 30, 2004. A Notice of Appeal was timely filed on April 21, 2004.

I. REAL PARTY IN INTEREST

The real party in interest is International Business Machines Corp., Armonk, New York, assignee of 100% interest of the above-referenced patent application.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellant's legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-20 are all the claims pending in the application and are set forth fully in the attached appendix. Claims 1-20 were originally filed in the application. The claims were not amended in 1.116 Response filed March 23, 2004. Therefore, the claims in the attached Appendix are as amended by the January 9, 2004 Amendment.

IV. STATEMENT OF AFTER-FINAL AMENDMENTS

In response to the final Office Action dated January 30, 2004, Appellants filed a Response Under 37 CFR 1.116 on March 23, 2004. This response did not make any claim amendments. An Advisory Action dated April 7, 2004 indicated that the Response did not place the application in condition for allowance. The claims shown in the appendix are shown in their amended form as of the January 9, 2004 Amendment.

V. SUMMARY OF THE INVENTION

The invention uses a conducting amorphous film (carbon film or diamond-like carbon film) 35 to passivate both the electrode 38 and the pixel electrode 32 of a reflective-type AMLCD shown in Figure 5A which makes the Vcom shift uniformly small across the display panel and stable over time under different operating conditions. Claims 1 and 15 define this layer as "a conducting amorphous layer" and claim 8 defines this layer as "a conducting diamond-like amorphous carbon layer." The Office Action argues that any material has conductivity and uses such reasoning to conclude that an insulator layer in one of the prior art references has "slight" conductivity and, therefore, teaches the claimed conducting amorphous layer. Appellants

strongly disagree.

With the inventive DLC layer 35, the Vcom shift is small and stable so that the display can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker. Further, the invention has lower power consumption because the display is driven with frame-inversion at low frequencies which allows lower voltage drivers to be used for the display. Because the voltage drop across the DLC film is much lower than that of PI film, low-cost CMOS processes for active substrates may be used. Also, with the invention, no extra mechanism is required to detect the Vcom shift in real time to provide feedback for the adjustment of Vcom voltage to minimize the flicker.

VI. ISSUES PRESENTED FOR REVIEW

The issues presented for review by the Board of Patents Appeals and Interferences are whether claims 1-3, 5, 7-10, 12, 14-17, and 19 are unpatentable over Yasukawa (U.S. Patent No. 6,344,888) in view of Chouan or Grinberg et al. (hereinafter "Grinberg"); whether claims 4, 11, and 18 are similarly unpatentable further in view of Hanihara et al. (hereinafter "Hanihara"); and whether claims 6, 13, and 20 are similarly unpatentable further in view of Admitted Prior Art (APA).

VII. GROUPING OF THE CLAIMS

As supported by the following arguments, the claims are each independently patentable and do not stand or fall together. More specifically, the dependent claims are patently distinct from the independent claims from which they depend because each dependent claim defines additional features which are not defined in the independent claims or which are defined more broadly in the independent claims. As discussed in greater detail below, the features defined by

the dependent claims are not merely illustrations or examples but include patentable features which prevent the dependent claims from standing or falling with their associated independent claim.

VIII. ARGUMENT

A. The 103(a) Rejection of Independent Claims 1, 8, and 15 Based on Yasukawa in view of Chouan and Grinberg

1. The Position in the Office Action

With respect to the rejection of independent claims 1, 8, and 15, the Office Action states that Yasukawa discloses (col. 15, lines 25-52; col.6, line 48 - col.7, line 52; Figs. 7 and 1) a reflective liquid crystal panel comprising a counter electrode (common electrode) composed of a transparent electrode (ITO) (33), i.e., a first-type electrode or a transmissive electrode; a reflective electrode (pixel electrode 14), i.e., a second-type electrode or a reflective electrode positioned opposite the transmissive electrode (the transmissive electrode is an opposite type of the reflective electrode); a liquid crystal material (37) between the transmissive electrode (33) and the reflective electrode (14); a passivation film (17) formed on the entire pixel electrode (14) which is adjacent the liquid crystal material; and that the passivation film (17) is composed of a silicon oxide film.

The Office Action declares that because the amorphous layer (or the amorphous carbon layer) comprises a silicon oxide, that Yasukawa discloses that an amorphous layer comprises silicon oxide film as the passivation film. The Office Action recites that Yasukawa indicates (col. 7, lines 20-23) that the use of a silicon oxide film as the passivation film (17) covering the pixel region prevents significant change in reflectance due to the variation of film thickness and the wavelength of the light, such that preventing the display flickers. On the other hand, the Office Action notes that any material has conductivity. The Office Action states that using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8, and 15 also have slight conductivity, so that the material also is a conducting (slight conductivity) material. The Office Action concludes that the diamond-like conductive film has a very slight conductivity. Therefore, the Office Action argues that the material using SiO_2 meets claims 1, 8 and 15.

2. Appellant's Response

a. No Prima Facie Case of Obviousness

Before addressing the individual prior art rejections, Appellants note that the Office Action fails to set forth a prima facia case of obviousness. Therefore, all rejections are defective and should be withdrawn. Generally, the fact that the references teach away from the claimed invention, the lack of any objective motivation to combine references, and the large number of references demonstrates that a *prima facia* case of obviousness has not been set forth.

More specifically, the primary reference Yasukawa requires that an insulator 17 (silicon oxide) be positioned as a passivating layer next to the electrodes (Col. 6, lines 58-59; Col. 7, lines 9-10). This teaches away from the claimed invention that utilizes "a conducting amorphous layer adjacent said liquid crystal material" as defined by independent claims 1, 3, 8, 10, 15, and 17. Clearly, by requiring that an insulator be positioned adjacent the liquid crystal material,

Yasukawa teaches directly away from the claimed invention which utilizes a conducting layer adjacent the liquid crystal material. Any modification of Yasukawa to require a different teaching would fail to set forth a prima facia case of obviousness. Contrary to conventional logic, the Office Action urges that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Appellants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide and silicon dioxide are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon oxide layer 17 as an insulator and calls the layer a "passivating layer." Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light (Col. 7, lines 20-24). Therefore, not only is the Office Action urging a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference. Therefore, because Yasukawa teaches away from the claimed invention, a prima facia case of obviousness has not been set forth.

In order to modify Yasukawa, the Office Action proposes that one ordinarily skilled in the art would have somehow referred to the Chouan reference (which is not related to liquid crystal devices, but instead is related to conventional transistors) and/or to the Grinberg reference (which is directed to a liquid crystal light valve). While each of the secondary references Chouan and Grinberg discloses a layer that has a specific level of resistivity, there is no indication that the layers referenced in the secondary references should be substituted for the insulator layer and Yasukawa. Today's integrated circuit devices use conductive layers and insulating layers. Simply because a reference discloses an insulator layer or a conductor layer with a specific range of resistivity in no way teaches one ordinarily skilled in the art to substitute the insulator layer in Yasukawa for a conductive layer, much less the claimed "conducting amorphous layer adjacent said liquid crystal material, wherein said conducting amorphous layer has a resistivity between 10^4 and 10^{11} ohms-cm" that is defined by independent claims 1, 3, 8, 10, 15, and 17. Therefore,

because there is no motivation or teaching in the prior art for substituting the various layers of the secondary references Chouan and Grinberg for the insulator layer of Yasukawa, a prima facia case of obviousness has not been set forth.

It is improper for a rejection to be based upon hindsight reasoning. In this instance, the Office Action selects certain features from one prior art reference and different features from other prior art references in an attempt to recreate Appellants' claimed invention based solely upon Appellants disclosure. In this Office Action, up to four different references are combined in order to form the rejections. This large number of references clearly indicates that the Office Action is based upon hindsight reasoning. Therefore, because the rejections are based upon hindsight reasoning, a prima facia case of obviousness has not been set forth.

Thus, as shown above, a prima facia case of obviousness has not been set forth in the Office Action. The rejections are therefore defective and should be withdrawn on this basis alone. Notwithstanding this deficiency, the merits of the proposed combination of references are discussed below.

Yasukawa does not teach or suggest the use of a diamond-like conductive film adjacent one or both of the electrodes in a reflective LCD device as in the claimed invention. Claims 1 and 15 define this layer as "a conducting amorphous layer" and claim 8 defines this layer as "a conducting diamond-like amorphous carbon layer." On page 3, second paragraph, the Office Action argues that any material has conductivity and uses such reasoning to conclude that the silicon oxide passivation film 17 in Yasukawa has "slight" conductivity and, therefore, teaches the claimed conducting amorphous layer. Appellants strongly disagree.

Yasukawa requires that an insulator (silicon oxide) be positioned as a passivating layer next to the electrodes. On pages 7 and 8, the Office Action argues that Yasukawa discloses the claimed invention by using a silicon oxide film 17. More specifically, the Office Action states that "any material has conductivity. Using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8 and 15 also have supplied conductivity, so that the material also is a conducting (slight cannot activity) material. The diamond-like conductive film has a very

slight conductivity." In other words, the Office Action argues that the amorphous insulator 17 disclosed in Yasukawa teaches the "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8).

Appellants agree that claim language should be interpreted broadly during examination; however, such an interpretation cannot reach the point of being so broad as to contradict the clear meaning of the term being interpreted. Here, the claims clearly define a "conducting" layer. Silicon oxide is an insulator, unless modified (as with carbon) so that it changes its insulating characteristics.

The Office Action urges that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Appellants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide (and silicon dioxide) are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon dioxide layer 17 as an insulator and calls the layer a "passivating layer." Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light. Therefore, not only is the Office Action urging a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference.

Further, the Office Action argues that silicon oxide has a "slight" amount of conductivity. However, this language is not included in the claims. To the contrary, the claims merely define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). The terminology "slightly conducting" is not used in the independent claims. Therefore, the position in the Office Action is additionally erroneous because it is reading limitations into the claims that are not there.

In addition, the Office Action proposes that since some of the dependent claims define the conducting amorphous layer as including ("comprising") silicon dioxide that silicon dioxide should be considered a conductor. But, Appellants submit that this logic is flawed because of the

legal meaning of the word "comprising." More specifically, the dependent claims define that the amorphous layer can "comprise" a number of substances, one of which is a silicon dioxide. This is legally interpreted to mean that one of the elements within the layer is silicon dioxide. This does not mean that the layer is exclusively silicon dioxide. Instead, if Appellants had intended such a meaning, they would have used more restrictive language such as "consisting of" or "consisting essentially of." The paragraph appearing on page, lines 10-15, explains that the silicon dioxide layer is changed from an insulator into a conductor using a form of carbon.

As shown above, Appellants respectfully submit that in attempting to broadly interpret the claim language and the teachings of the prior art, that the Office Action has exceeded what is permitted. More specifically, classifying the passivating layer of silicon dioxide in Yasukawa as a conductor exceeds the boundaries permitted on broad interpretation. The claims clearly and unambiguously define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). To the contrary, Yasukawa discloses a passivating layer 17, nothing more. Therefore, Yasukawa does not teach or suggest the claimed invention.

As explained in column 16, lines 51-59 of Yasukawa, the prior art requires a passivating insulator 17. This requirement to use an insulator 17 teaches away from the claimed invention which uses a "conducting amorphous" layer adjacent at least one of the electrodes. Therefore, Appellants respectfully submit that independent claims 1, 8, and 15 are patentable over Yasukawa, and the Board is respectfully requested to remove the prior art rejection of independent claims 1, 8, or 15.

b. Yasukawa, Chouan, and Grinberg do not teach the claimed invention

Yasukawa does not teach or suggest the use of a diamond-like conductive film adjacent one or both of the electrodes in a reflective LCD device, as in the claimed invention. To the

contrary, Yasukawa requires that an insulator 17 (silicon oxide) be positioned as a passivating layer next to the electrodes. The Office Action argues that Yasukawa discloses the amorphous insulator 17 and therefore teaches the "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8).

Appellants agree that claim language should be interpreted broadly during examination; however, such an interpretation cannot reach the point of being so broad as to contradict the clear meaning of the term being interpreted. Here, the claims clearly define a "conducting" layer that "has a resistivity between 10^4 and 10^{11} ohms-cm." Silicon dioxide is an insulator, unless modified (as with carbon in the invention) so that it changes its insulating characteristics. There is no teaching in the prior art of record of altering the silicon oxide insulator in Yasukawa to include carbon or in any other way to become a conductor.

The Office Action states that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Appellants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide (and silicon dioxide) are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon oxide layer 17 as an insulator and calls the layer a "passivating layer." Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light. Therefore, not only is the Office Action proposing a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference.

Further, the Office Action argues that silicon oxide has a "slight" amount of conductivity. However, this language is not included in the claims. To the contrary, the claims define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8) each of which "has a resistivity between 10^4 and 10^{11} ohms-cm." The terminology "slightly conducting" is not used in the independent claims. Therefore, the position

in the Office Action is additionally erroneous because it is reading limitations into the claims that are not there.

Chouan discloses a method of using hydrogenated carbon film to insulate amorphous silicon which is used to form thin film transistors for AMLCD from ions migrated from glass substrates. Therefore, the purpose of this carbon film is insulation. It is repeatedly stated several times in the text, such as column 2 line 65-68, column 3 line 48-49, column 4 line 67, column 5 line 19-23, and in claims 2 and 10 of Chouan. Since the carbon film in Chouan is used to block ions or insulation the resistivity is 10^{12} and 10^{14} ohms-cm, which is outside the claimed range.

The resistivity of the amorphous carbon film can vary largely from 10^{4} and 10^{18} ohms-cm by process parameters and especially by hydrogen concentration, deposition temperature and pressure, bias power and precursors. Usually, the higher hydrogen content films have higher resistances but are softer and not stable. The films with lower hydrogen content have lower resistivity, are harder, and more stable. Therefore, while a carbon film can be insulating, Chouan does not teach or suggest the type of the film used in the claimed invention and the film in Chouan does not have the properties utilized in the claimed invention. The resistivity of the film in Chouan is between 10^{12} and 10^{14} ohms-cm, which is above the claimed range of between 10^{4} and 10^{11} ohms-cm.

Grinberg describes a method of making electron beam addressed LCD with a partially conducting material to absorb the electrons from the electron beam to control the voltage across the liquid crystal. The function of the partially conducting material in Grinberg is to absorb electrons and low the resistivity of the electrode at the location where the e-beam is to shine makes the composite electrodes conductive and turns on the pixel. This layer is part of the electrodes and not in contact with liquid crystal. There is no teaching or suggestion that this layer should be used adjacent the liquid crystal.

In addition, the layer 10 or 10a in the Grinberg is clearly described as a passivation layer and is defined to be an "insulating film" in column 3 line 55. Further, Grinberg utilizes this layer as an insulator and describes that the resistivity should be between 10^{9} and 10^{11} ohms-cm. To the

contrary, the inventive "conductive" layer has a much more conductive range of resistivity between 10^4 and 10^{11} ohms-cm. While there is some overlap between the two ranges, the use and positioning of the layer in Grinberg clearly demonstrates that it is an insulator and the higher range of resistivity confirms that it is an insulator. To the contrary, the claimed structure is defined as a conductor and has resistivity in the range of a conductor. Therefore, not only does Grinberg fail to teach a conductor in the position defined by the claims, Grinberg clearly defines and describes its layer as an insulator. Therefore, no teaching in Grinberg would lead one ordinarily skilled in the art to substitute a conductor in place of the insulator layer 17 of Yasukawa.

The issue of importance in this situation is not whether the specific measure of resistivity (for example, 10^9 ohms-cm) is definitely a "conductor" or "insulator", but instead whether the teachings of Grinberg would cause one ordinarily skilled in the art to modify the insulator layer 17 of Yasukawa in such a manner so as to make the insulator layer 17 of Yasukawa into a conductor. The difference of whether a certain material comprises a conductor or an insulator depends upon the specific design and the location of the layer within the specific design. Therefore, at one location a layer having a resistivity of 10^9 ohms-cm could function as an insulator, while the same layer could function as a conductor in a different structure. The important feature to be understood is that in its specific location, within a narrow resistivity range, a specific layer could act as a conductor or an insulator. In the claimed invention, the layer clearly comprises a "conductive" layer while in Grinberg the layer is clearly described as an insulator. Therefore, no motivation is provided to one ordinarily skilled in the art to change insulator 17 in Yasukawa into a conductor. Thus, it is Appellants position that the proposed combination of references does not teach or suggest the claimed invention.

As shown above, Appellants respectfully submit that in attempting to broadly interpret the claim language and the teachings of the prior art, the Office Action has exceeded what is permitted. More specifically, classifying the passivating layer of silicon oxide in Yasukawa as a conductor exceeds the boundaries permitted on broad interpretation. The claims clearly and

unambiguously define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8) each of which "has a resistivity between 10^4 and 10^{11} ohms-cm." To the contrary, Yasukawa discloses a passivating layer 17, nothing more. Therefore, Yasukawa does not teach or suggest the claimed invention.

As explained in column 16, lines 51-59 of Yasukawa, the prior art requires a passivating insulator 17. This requirement to use an insulator 17 teaches away from the claimed invention which uses a "conducting amorphous" layer adjacent at least one of the electrodes. These secondary references Chouan and Grinberg do not include any teaching that would modify this insulator layer 17 into a conductor. Therefore, Yasukawa does not teach or suggest the invention as defined by independent claims 1, 8, or 15 and these independent claims are patentable over Yasukawa.

B. The 103(a) Rejection of Dependent Claims 2, 3, 5, 7, 9, 10, 12, 14, 16, 17, and 19 Based on Yasukawa in view of Chouan and Grinberg

1. The Position in the Office Action

With respect to the rejection of claims 2, 3, 5, 7, 9, 10, 12, 14, 16, 17, and 19, the Office Action states that Yasukawa discloses (col. 15, lines 25-52; col.6, line 48 - col.7, line 52; Figs. 7 and 1) a reflective liquid crystal panel comprising a counter electrode (common electrode) composed of a transparent electrode (ITO) (33), i.e., a first-type electrode or a transmissive electrode; a reflective electrode (pixel electrode 14), i.e., a second-type electrode or a reflective electrode positioned opposite the transmissive electrode (the transmissive electrode is an opposite type of the reflective electrode); a liquid crystal material (37) between the transmissive electrode (33) and the reflective electrode (14); a passivation film (17) formed on the entire pixel electrode (14) which is adjacent the liquid crystal material; and that the passivation film (17) is composed of a silicon oxide film.

The Office Action states that because the amorphous layer (or the amorphous carbon layer) comprises a silicon oxide, that Yasukawa discloses that an amorphous layer comprises silicon oxide film as the passivation film. The Office Action recites that Yasukawa indicates (col. 7, lines 20-23) that the use of a silicon oxide film as the passivation film (17) covering the pixel region prevents significant change in reflectance due to the variation of film thickness and the wavelength of the light, such that preventing the display flickers. On the other hand, the Office Action notes that any material has conductivity. The Office Action states that using SiO_2 as the amorphous layer or the amorphous carbon layer as claimed in claims 1, 8, and 15 also have slight conductivity, so that the material also is a conducting (slight conductivity) material. The Office Action concludes that the diamond-like conductive film has a very slight conductivity Therefore, the Office Action concludes that the material using SiO_2 meets the claims 1, 8 and 15.

With respect to claims 5, 12 and 19, the Office Action declares that Yasukawa discloses (col. 7, lines 37-38) that a polyimide alignment film is formed on the entire passivation film (17), i.e., a polyimide layer is formed between the passivation film (as the amorphous layer) and the liquid crystal material.

2. Appellant's Response and Independent Patentability of the Dependent Claims 2, 3, 5, 7, 9, 10, 12, 14, 16, 17, and 19

Dependent claims 2, 9, and 16 define transmissive-type and reflective-type electrodes. Yasukawa is argued to disclose such type of electrodes in the Office Action. However, as shown above, Yasukawa is deficient in teaching that one of these electrodes is a "conducting amorphous layer" (claims 1 and 15) or "conducting diamond-like amorphous carbon layer" (claim8). Contrary to such conductive layers, the reference actually teaches a passivating layer. Therefore, Appellants submit that the prior art of record does not teach or suggest using such a conductive amorphous layer as a transmissive-type or reflective-type electrode and that dependent claims 2, 9, and 16 are not anticipated by Yasukawa, Chouan and Grinberg and that the concept of using a

conducting amorphous layer for the transmissive-type or reflective-type electrode is a concept that is independently patentable.

Dependent claims 3, 10, and 17 explicitly define subcomponents that make up the conducting amorphous layer defined in independent claims 1, 8, and 15. As shown above, Yasukawa, Chouan and Grinberg do not teach such a conducting amorphous layer. Therefore, Yasukawa cannot teach the components that make up such a layer. Further, such components are not shown as being conventionally used as a conducting amorphous layer in a display as in the claimed invention. Thus, Appellents submit that dependent claims 3, 10, and 17 are independently patentable over the prior of record.

Dependent claims 5, 12, and 19 define a specific layer between the conducting amorphous layer and the liquid crystal material defined by independent claims 1, 8, and 15. Once again, since Yasukawa, Chouan and Grinberg do not teach such a conducting amorphous layer, it cannot teach a structure that includes various materials between the conducting amorphous layer and the liquid crystal material. Similarly, given this deficiency, the prior art of record does not teach or suggest the use of such liquid crystal material. Thus, dependent claims 5, 12, and 19 are not anticipated by Yasukawa, Chouan and Grinberg and are independently patentable over prior art of record.

Dependent claims 7 and 14 define that the amorphous layer comprises a passivating layer. This again highlights the distinction between the claimed invention and the Yasukawa, Chouan and Grinberg references. More specifically, Yasukawa, Chouan and Grinberg clearly defines a silicon oxide passivation film 17 (column 7, lines 9-10), while the claimed invention utilizes the conducting amorphous layer as the passivating layer. The invention defines a "conducting" material while the references defines an insulating material. Therefore, for the reasons shown above, dependent claims 7 and 14 are not anticipated by Yasukawa, Chouan and Grinberg and are independently patentable over the prior of record.

Further, dependent claims 2, 5, 9, 12, 14, 16, and 19 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the

additional features of the invention they define. In view of the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

C. The 103(a) Rejection of Dependent Claims 4, 11, and 18 Based on Yasukawa in View of Chouan and Grinberg and further in view of Hanihara

1. The Position in the Office Action

With respect to claims 4, 11, and 18, the Office Action states that it was known that the silicon oxide film can be an alignment film. The Office Action argues that Hanihara discloses (col.5, lines 52-53) that an alignment film (8) made of silicon oxide is formed on the electrode (7), such that the silicon oxide film has a function to be an alignment film. The Office Action declares that because the amorphous layer comprises silicon oxide, that the amorphous layer made of silicon oxide has a unidirectional orientation matched to the liquid crystal material. Therefore, the Office Action concludes that an alignment film as claimed in claims 4, 11 and 18 would have been at least obvious.

2. Appellant's Response and Independent Patentability of the Dependent Claims 4, 11, and 18

Hanihara does not cure the deficiency of the combination of Yasukawa, Chouan, and Grinberg, shown above. More specifically, Hanihara does not teach or suggest the conductive amorphous layer defined by independent claims 1, 8, and 15. Indeed, Hanihara is only referenced for showing that silicon oxide has a unidirectional orientation matched to the liquid crystal material and is not intended to teach or suggest a diamond-like conductive amorphous layer. Therefore, any combination of Hanihara and Yasukawa would not teach or suggest "a conducting amorphous layer adjacent said liquid crystal material"; "a conducting amorphous diamond-like carbon layer adjacent

said liquid crystal material"; or "forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively.

Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa and Hanihara. Further, dependent claims 4, 11, and 18 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. More specifically, claims 4, 11, and 18 define a feature of the amorphous layer relating to the orientation of the layer. Because the prior art only teaches an insulator, it cannot teach the orientation of the conducting amorphous layer. In view of the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

D. The Rejection of Dependent claims 6, 13, and 20 Based on Yasukawa in View of Admitted Prior Art (APA)

1. The Position in the Office Action

With respect to claims 6, 13, and 20, the Office Action states that it was known that the voltage between the pixel electrode and the common electrode varies the transparency of the liquid crystal material. The Office Action argues that Appellant's admitted prior art discloses (col. 3, lines 1-4 in the specification) that varying the voltage to the electrode (106) (the pixel electrode) controls the liquid crystal cell (111) such that different amounts of light are transmitted across the liquid crystal display (different transparency of liquid crystal material), thus resulting in the display of a gray scale of light. Therefore, the Office Action concludes that a voltage between the transmissive electrode and the reflective electrode varies the transparency of the liquid crystal material as claimed in claims 6, 13, and 20 would have been at least obvious.

2. Appellants' Response and Independent Patentability of the Dependent Claims

Neither the APA nor Yasukawa teach or suggest the conductive amorphous layer defined by independent claims 1, 8, and 15. The APA (Figure 1, page 2, line 18-page 3, line 10 of the specification) teaches that when a voltage below a threshold voltage is applied to the gate line 107, the transistor 109 is in an off-condition so that the potential on the data bus line 108 and electrode 106 are isolated from one another. When a voltage larger than the threshold voltage is applied on the gate bus line 107, the transistor 109 is in an on-condition (low impedance state), thereby allowing the voltage on the data bus line 108 to charge the electrode 106. Varying the voltage to the electrode 106 controls the liquid crystal cell 111 such that different amounts of light are transmitted across the liquid crystal display, thus resulting in the display of a gray scale of light. A reflective-type AMLCD is similar in structure to the transmissive-type AMLCD; however, the transparent electrode 106 is usually replaced with a reflective metal electrode which generally occupies a larger area to cover the transistor 109.

As shown above, the claimed invention is fundamentally different than any of the teachings in the prior art. The invention avoids flicker LCD problems by using a conducting thin film, e.g., diamond-like carbon (DLC) film, coated on both the Al and ITO electrodes of reflective LCDs to reduce and stabilize the Vcom shift. The conducting film allows electrical charges to flow toward the electrodes and bend the Fermi level of the adjacent electrode and balance the surface potential. Thus, with the invention, the Vcom shift is small and stable so that the display can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker.

Such features are simply not taught or suggested by the prior art of record. More specifically, none of the applied references teaches or suggests "a conducting amorphous layer adjacent said liquid crystal material"; "a conducting amorphous diamond-like carbon layer adjacent said liquid crystal material"; and "forming a conducting amorphous layer on at least one

of said first-type electrode and said second-type electrode adjacent said liquid crystal material," as defined by independent claims 1, 8, and 15, respectively.

Therefore, independent claims 1, 8, and 15 are patentable over any combination of Yasukawa and the APA. Dependent claims 6, 13, and 20 define that the voltage between the first-type and reflective electrodes controls the transparency of the liquid crystal material. As shown above, Yasukawa is deficient in teaching that one of these electrodes is a "conducting amorphous layer" (claims 1 and 15) or "conducting diamond-like amorphous carbon layer" (claim 8). Contrary to such conductive layers, the prior art actually teaches a passivating layer. Therefore, Appellants submit that the prior art of record does not teach or suggest using such a conductive amorphous layer to control the transparency of the liquid crystal material as defined by dependent claims 6, 13, and 20. Therefore, dependent claims 6, 13, and 20 are patentable over the prior art of record. The concept of using a conducting amorphous layer to control the transparency of the liquid crystal material is a concept that is independently patentable. In view of the forgoing, the Board is respectfully requested to reconsider and withdraw this rejection.

IX. CONCLUSION

The invention uses a conducting amorphous film (carbon film or diamond-like carbon film) 35 to passivate both the electrode 38 and the pixel electrode 32 of a reflective-type AMLCD shown in Figure 5A which makes the Vcom shift uniformly small across the display panel and stable over time under different operating conditions. Claims 1 and 15 define this layer as "a conducting amorphous layer" and claim 8 defines this layer as "a conducting diamond-like amorphous carbon layer." The Office Action argues that any material has conductivity and uses such reasoning to conclude that an insulator layer in one of the prior art references has "slight" conductivity and, therefore, teaches the claimed conducting amorphous layer. Appellants strongly disagree.

Appellants agree that claim language should be interpreted broadly during examination; however, such an interpretation cannot reach the point of being so broad as to contradict the clear meaning of the term being interpreted. Here, the claims clearly define a "conducting" layer. Silicon oxide is an insulator, unless modified (as with carbon) so that it changes its insulating characteristics.

The Office Action urges that the silicon oxide insulator disclosed in Yasukawa should be considered a conductor because all materials have some level of conductivity, no matter how slight. Appellants respectfully disagree that silicon oxide should be classified as a conductor for a number of reasons, the first and foremost of which is that silicon oxide (and silicon dioxide) are categorized by those skilled in this art field as insulators. Silicon oxide is not used as a conductor. Further, Yasukawa uses the silicon dioxide layer 17 as an insulator and calls the layer a "passivating layer". Yasukawa uses silicon oxide to prevent significant change in reflectance due to the variation of film thickness and wavelength of light. Therefore, not only is the Office Action urging a meaning of silicon oxide that is contrary to the well-known meaning, it is also contrary to the meaning intended in the reference.

Further, the Office Action argues that silicon oxide has a "slight" amount of conductivity. However, this language is not included in the claims. To the contrary, the claims merely define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). The terminology "slightly conducting" is not used in the independent claims. Therefore, the position in the Office Action is additionally erroneous because it is reading limitations into the claims that are not there.

With the inventive DLC layer 35, the Vcom shift is small and stable so that the display can be operated in the frame-inversion drive with a frame rate lower than 70 Hz without perceivable flicker. Further, the invention has lower power consumption because the display is driven with frame-inversion at low frequencies which allows lower voltage drivers to be used for the display. Because the voltage drop across the DLC film is much lower than that of PI film, low-cost CMOS processes for active substrates may be used. Also, with the invention, no extra

mechanism is required to detect the Vcom shift in real time to provide feedback for the adjustment of Vcom voltage to minimize the flicker.

Appellants respectfully submit that in attempting to broadly interpret the claim language and the teachings of the prior art, that the Office Action has exceeded what is permitted. More specifically, classifying the passivating layer of silicon dioxide in Yasukawa as a conductor exceeds the boundaries permitted on broad interpretation. The claims clearly and unambiguously define a "conducting amorphous layer" (claims 1 and 15) and "conducting amorphous diamond-like carbon layer" (claim 8). To the contrary, Yasukawa discloses a passivating layer 17, nothing more. No other prior art of record is referenced in the Office Action for teaching this feature. In view the forgoing, the Board is respectfully requested to reconsider and withdraw the foregoing rejections.

In view of the foregoing, Appellants submit that claims 1-20, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance.

Please charge any deficiencies and credit any overpayments to Attorney's deposit account number 50-0510.

Respectfully submitted,

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APPENDIX

1. (Previously Presented) A reflective-type liquid crystal display comprising:

a first-type electrode;

a second-type electrode positioned opposite said first-type electrode and being of an opposite type than said first-type electrode; and

a liquid crystal material between said first-type electrode and said second-type electrode,

wherein at least one of said first-type electrode and said second-type electrode includes a conducting amorphous layer adjacent said liquid crystal material, wherein said conducting amorphous layer has a resistivity between 10^4 and 10^{11} ohms-cm.

2. (Original) The reflective-type liquid crystal display in claim 1, wherein said first-type electrode comprises a transmissive-type electrode and said second-type electrode comprises a reflective-type electrode.

3. (Previously Presented) A reflective-type liquid crystal display comprising:

a first-type electrode;

a second-type electrode positioned opposite said first-type electrode and being of an opposite type than said first-type electrode; and

a liquid crystal material between said first-type electrode and said second-type electrode,

wherein at least one of said first-type electrode and said second-type electrode includes a conducting amorphous layer adjacent said liquid crystal material, wherein said conducting amorphous layer has a resistivity between 10^4 and 10^{11} ohms-cm, and

wherein said amorphous layer comprises one of a hydrogenated amorphous carbon silicon, germanium, SiO_2, Si_3N_4 and TiO_2.

4. (Original) The reflective-type liquid crystal display in claim 1, wherein said amorphous layer has a unidirectional orientation matched to said liquid crystal material.

5. (Original) The reflective-type liquid crystal display in claim 1, further comprising one of a polyimide layer, polyamide layer and oblique-evaporated inorganic layer between said amorphous layer and said liquid crystal material.

6. (Original) The reflective-type liquid crystal display in claim 1, wherein a voltage between said first-type electrode and said reflective electrode varies a transparency of said liquid crystal material.

7. (Original) The reflective-type liquid crystal display in claim 1, wherein said amorphous layer comprises a passivation layer.

8. (Previously Presented) A reflective-type liquid crystal display comprising:

a transmissive electrode;

a reflective electrode positioned opposite said transmissive electrode; and

a liquid crystal material between said transmissive electrode and said reflective electrode,

wherein at least one of said transmissive electrode and said reflective electrode includes a conducting diamond-like amorphous carbon layer adjacent said liquid crystal material, wherein said diamond-like conducting amorphous carbon layer has a resistivity between 10^4 and 10^{11} ohms-cm.

9. (Original) The reflective-type liquid crystal display in claim 8, wherein said transmissive electrode comprises indium tin oxide and said reflective-type electrode comprises aluminum.

10. (Previously Presented) A reflective-type liquid crystal display comprising:

a transmissive electrode;

a reflective electrode positioned opposite said transmissive electrode; and

a liquid crystal material between said transmissive electrode and said reflective electrode,

wherein at least one of said transmissive electrode and said reflective electrode includes a conducting diamond-like amorphous carbon layer adjacent said liquid crystal material, wherein said diamond-like conducting amorphous carbon layer has a resistivity between 10^4 and 10^{11} ohms-cm, and

wherein said amorphous carbon layer comprises one of a hydrogenated amorphous carbon silicon, germanium, SiO_2, Si_3N_4 and TiO_2.

11. (Original) The reflective-type liquid crystal display in claim 8, wherein said amorphous carbon layer has a unidirectional orientation matched to said liquid crystal material.

12. (Original) The reflective-type liquid crystal display in claim 8, further comprising one of a polyimide layer, polyamide layer and oblique-evaporated inorganic layer between said amorphous carbon layer and said liquid crystal material.

13. (Original) The reflective-type liquid crystal display in claim 8, wherein a voltage between said transmissive electrode and said reflective electrode varies a transparency of said liquid crystal material.

14. (Original) The reflective-type liquid crystal display in claim 8, wherein said amorphous carbon layer comprises a passivation layer.

15. (Previously Presented) A method of forming a reflective-type liquid crystal display comprising:

forming a first-type electrode;

forming a second-type electrode positioned opposite said first-type electrode and being of an opposite type than said first-type electrode;

forming a liquid crystal material between said first-type electrode and said second-type electrode; and

forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material, wherein said conducting amorphous layer is formed to have a resistivity between 10^4 and 10^{11} ohms-cm.

16. (Original) The method in claim 15, wherein said forming of said first-type electrode comprises forming a transmissive-type electrode and said forming of said second-type electrode comprises forming a reflective-type electrode.

17. (Previously Presented) A method of forming a reflective-type liquid crystal display comprising:

forming a first-type electrode;

forming a second-type electrode positioned opposite said first-type electrode and being of an opposite type than said first-type electrode;

forming a liquid crystal material between said first-type electrode and said second-type electrode; and

forming a conducting amorphous layer on at least one of said first-type electrode and said second-type electrode adjacent said liquid crystal material, wherein said conducting amorphous layer is formed to have a resistivity between 10^4 and 10^{11} ohms-cm, and

wherein said forming of said amorphous layer comprises forming one of a hydrogenated amorphous carbon silicon, germanium, SiO_2, Si_3N_4 and TiO_2 layer.

18. (Original) The method in claim 15, wherein method includes forming said amorphous layer to have a unidirectional orientation matched to said liquid crystal material.

19. (Original) The method in claim 15, further comprising forming one of a polyimide layer, polyamide layer and oblique-evaporated inorganic layer between said amorphous layer and said liquid crystal material.

20. (Original) The method in claim 15, wherein a voltage between said first-type electrode and said reflective electrode varies a transparency of said liquid crystal material.

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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.
YO998532

In Re Application Of: **METHODS OF REDUCING UNBALANCED DC VOLTAGE BETWEEN TWO ELECTRODES OF REFLECTIVE LIQUID DISPLAY BY THIN FILM PASSIVATION**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
09/296,588	**April 23, 1999**	**Qi Zhi Qian**	**29154**	**2871**	

Invention: **METHODS OF REDUCING UNBALANCED DC VOLTAGE BETWEEN TWO ELECTRODES OF REFLECTIVE LIQUID DISPLAY BY THIN FILM PASSIVATION**

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

The fee for filing this Appeal Brief is: **$330.00**

☐ A check in the amount of the fee is enclosed.

☒ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **50-0510**

Signature

Dated: **June 16, 2004**

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I certify that this document and fee is being deposited on **June 16, 2004** with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature of Person Mailing Correspondence

Frederick W. Gibb, III

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